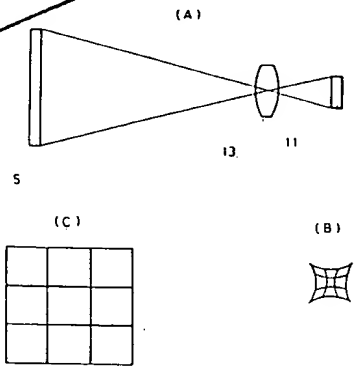
(54) OPTICAL DEVICE
(11) 3-241310 (A) (43) 28.10.1991 (19) JP
(21) Appl. No. 2-37388 (22) 20.2.1990
(71) CITIZEN WATCH CO LTD (72) NOBUYUKI HASHIMOTO
(51) Int. Cl⁵. G02B27/18,G02B9/00

PURPOSE: To simplify the optical system by constituting the device so that the optical system has an image formation distortion caused by an aberration, and a display image of an image display element has a distortion for compensating the image formation distortion of the optical system.

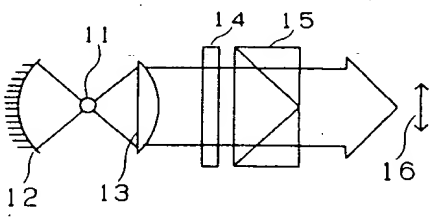
CONSTITUTION: By giving an image formation distortion caused by an aberration which an optical system has and a distortion of the opposite tendency to a display image, both the distortions are compensated each other and a correct image formation image is obtained. That is, in the case the optical system 13 has a barrel-shape distortion aberration, when a lattice-like display image having a pin cushion distortion as shown in B being opposite to an aberration of the optical system exists in an image display element 11, the distortion of the image and the aberration of the optical system are offset and on a screen 5, a correct lattice-like image formation image as shown in C is obtained. In this case, when resolving power and enlargement magnification of the optical system, overall length of the optical system, etc., are the same as a conventional optical device, generally, the number of pieces of lenses of the optical system can be decreased.



(54) POLARIZATION LIGHT SOURCE DEVICE
(11) 3-241311 (A) (43) 28.10.1991 (19) JP
(21) Appl. No. 2-38765 (22) 20.2.1990
(71) SEIKO EPSON CORP (72) TADAAKI NAKAYAMA
(51) Int. Cl⁵. G02B27/28,G02F1/13,G02F1/1335,G03B21/14,G09F9/00

PURPOSE: To efficiently convert light radiated from a light source lamp into linearly polarized light and to emit the light by forming an angle of 45° with the main cross section of a λ/4 wavelength plate and the polarization plane of lenearly polarized light reflected from a polariscope.

CONSTITUTION: The angle formed by the main cross section of the λ/4 wavelength plate and the polarization plane of a linearly polarized light reflected from the polariscope 15 is 45°. After non-polarized light emitted from a light source device passes through the λ/4 wavelength plate 14, the linearly polarized light is extracted by the polariscope 15. Linearly polarized light intersecting orthogonally with this linearly polarized light is reflected in the light incident direction and its opposite direction by the polariscope 15, and again passes through the λ/4 wavelength plate to be circularly polarized. This circularly polarized light is reflected by a reflector in the light source device to be circularly polarized in the opposite direction. This light passes again through the λ/4 wavelength plate 14 to be linearly polarized. At this time, the polarization plane of the linearly polarized light is intersected orthogonally with the polarization plane obtained when the light is reflected by the polariscope 15, therefore the light is emitted in the same direction and with the same plarization plane as those of the linearly polarized light extracted first after the light is again made incident on the polariscope 15. Since all the non-polarized light emitted from the light source device is converted into the linearly polarized light and used, the coefficient of utilization is increased.



(54) REFLECTION TYPE LIQUID CRYSTAL LIGHT VALVE
(11) 3-241312 (A) (43) 28.10.1991 (19) JP
(21) Appl. No. 2-38766 (22) 20.2.1990
(71) SEIKO EPSON CORP (72) TADAAKI NAKAYAMA
(51) Int. Cl⁵. G02B27/28,G02F1/13,G02F1/133,G02F1/1335,G02F1/137,G03B21/00, G09F9/30,H04N5/74

PURPOSE: To allow miniaturization and to obtain a high contrast ratio by changing the retardation of a liquid crystal layer by the voltage impressed between electrodes, thereby modulating incident light.

CONSTITUTION: The light past a polarization detector constituted of a polarizing plate 12 and a quarter-wave plate 13 is polarized into a circularly polarized light which is made incident on a reflection type liquid crystal panel 14. The incident circularly polarized light passes the liquid crystal layer and is then reflected as nearly linearly polarized light in the reflecting electrode while the voltage is not impressed if this liquid crystal panel 14 is of a twisted nematic type. This light passes the liquid crystal layer again and is converted into the circularly polarized light in the same rotating direction as the rotating direction at the time of incidence; therefore, the light is emitted as the linearly polarized light by the polarization detector. The retardation of the liquid crystal layer begins to decrease from a certain threshold voltage when the voltage is successively impressed to the liquid crystal layer and, therefore, the exit light decreases accordingly gradually until finally the exit light is not emitted any more. The incident circularly polarized light on the liquid crystal panel at this time arrives as it is at the reflecting electrode, by which the light is reflected to the circularly polarized light of the opposite direction. Since this light enters the polarization detector, the light is completely absorbed by the polarizing plate. The dependency of the contrast on the incident light angle is decreased and the small-sized and inexpensive light valve is obtd.